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IMPLEMENTING SUSTAINABLE SUPPLY CHAIN INITIATIVES IN THE SOUTH AFRICAN ROAD FREIGHT INDUSTRY

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ABSTRACT

Background: Fundamental changes in the global economy have resulted in complex supply chains that require continuous strategic adjustment in order to remain relevant, competitive and sustainable. Increased use of road freight transport has resulted in an increase in global greenhouse gas (GHG) emissions and impacts climate change.

Purpose: This study sought to explore the implementation of sustainable supply chain practices aimed to reduce GHG emissions in the South African road freight industry.

Method: Empirical data were collected from a convenience sample of 108 supply management profesionals employed at 13 logistics operating firms based in South Africa.

Findings: The results indicate that firms are placed under immense pressure to implement sustainable practices. The main drivers for adopting sustainable initiatives are pressure from consumer and brand protection; pressure from top management; and cost saving and revenue. The most implemented initiative identified is eco-driving, eco-routing (routing and scheduling) and increasing vehicle carrying capacity. The main benefits derived from implementing sustainable supply chain initiatives were operational cost savings; increased competitive advantage; and improved supplier relationships. However, the main challenges associated with implementing these initiatives were lack of government support; lack of understanding of the cost; and insufficient manpower.

Contribution: These results support the importance of sustainable supply chain management practices and aims to create awareness among the road freight transport firms regarding the importance of saving the environment and ensuring that environmental initiatives form part of the firm's social corporate responsibility.

INTRODUCTION

Profound changes in the global economy have brought about multifaceted supply chains that are characterised by complexities and uncertainties. There has been an extensive shift within the political, social and economic development of the world, which has changed the way in which global organisations operate. Coyle et al. (2013:17) identifies five main forces, viz. globalisation, technological advancements, empowered consumers, organisational consolidation and government regulations that drives the reformation of global supply chains. Kiessling, Harvey and Akdeniz (2014:672) is of the opinion that globalisation will be an everlasting phenomenon resulting in diminution of entry barriers into countries, advancement in technology which leads to an increase in the transfer of information, and that emerging markets will ultimately become a feasible substitute that ultimately reinvigorates mature products and industries. Thus, the need to re-examine supply chains is important especially since supply chains are evolving into global supply chain networks. Prajogo and Sohal (2013: 1535) states that the utilisation of technologies within the supply chain has brought about numerous operational benefits, including reduction in cost, improvements in service offering, as well as strategic benefits such as innovation and product planning improvements. Within the road freight transport industries, the demand for transport has increased dramatically resulting in a need for organisations to focus attention on technological systems that enable proficient management of the functioning of transportation systems and of traffic flow (Małecki, Iwan & Kijewska, 2014:215). Labrecque, Vor dem Esche, Mathwick, Novak and Hofacker (2013:261), point out that the ascending nature of the Internet removed time and geographic constraints thereby empowering consumers and with the variety of information that is available, consumers are more sophisticated, better educated, and consequently more demanding, have a methodically diverse pattern of shopping, and are difficult to persuade. Globalisation, supply chain collaboration and advancements in technology which enables visibility across the entire supply chain, organisations are able to realise mutual cost-saving benefits and customer-service improvements Coyle et al. (2013:10). Government regulations have also changed the way in which organisations operate within the supply chain. Coyle et al. (2013:11) suggest that deregulation within several industries such as transportation, financial and communication, has resulted in a rise of competition and has fostered changes in the manner in which organisations operate.

As a result, organisations have been forced to re-engineer their supply chain processes and strategies in order to remain competitive, operative and sustainable. Increased global production has brought about an increase in the movement of goods by different modes of transportation, particularly within the road freight industry. The increase in road freight transportation has resulted in an escalation in the emission of greenhouse gases (GHG) into the atmosphere, effecting climate change. The freight transport sector is perceived to be one of the major offenders responsible for increasing CO2 emissions through its massive fuel and energy consumption. Kenney, Castro, Ramani, Zietsman, Bhat, Farzaneh, Zhang, Bernardo and Narayanamoorthy (2014:1), reinforce this by explicitly indicating that the transport sector is one of the biggest contributor to GHG emmisions. Thambiran and Diab (2011:2683), assert that the global transport sector contributes to about 25% of CO2 emissions and that the road freight transport, specifically, is responsible for 80% the total CO2 emission. Also, Wolf and Seuring (2010) point out that global CO2 emissions are likely to increase by 70% by 2020. The adverse effects of these gases have intensified concerns of various stakeholders, consumers and society and as a consequence organisations have been pressurised to implement sustainable supply chain initiatives to reduce GHG emissions.

The driving forces responsible for the adoption of sustainable practices are those factors that influence an organisation to commence environmental sustainable practices. Literature identifies internal as well as external drivers. Diabat and Govindan (2011:661) explain that external drivers include investors, customers, government and non-governmental organisations. Internal drivers are those factors that result in the need to have contingency plans in place to mitigate potential interruptions within the supply chain, and seeking alternate equipment and material that minimise the impact on the environment by collaborating with suppliers. There are various drivers that are compelling organisations to implement sustainable strategies, including: consumer pressure and brand protection (Caniato, Caridi, Crippa & Moretto, 2012); governmental pressure (Walker, Di Sisto & McBain, 2008; Melville, 2010); reducing legal risk (Epstein & Buhovac, 2014); competitive pressure and technological innovation (Walker et al., 2008); pressure from supply chain members (Hsu, Tan, Zailani & Jayaraman, 2013); reducing supply chain disruptions to reduce risk (Reed & Willis, 2012); pressure from top management (Chin, Tat & Sulaiman, 2015) and cost savings and revenue growth (Epstein & Buhovac, 2014).

The implementation of sustainable initiatives within the supply chain has resulted in an evolution of SCM to sustainable supply chain management (SSCM). Brockhaus, Kersten and Knemeyer (2013:168) define SSCM as:

> *The strategic, transparent integration and achievement of an organisation's social, environmental, and economic goals in the systemic coordination of key inter-organisational business processes for improving the long-term economic performance of the individual company and its supply chains.*

A sustainable supply chain is one that integrates every activity into one supply chain thereby creating a holistic view. It is a process of being able to recognise and acknowledge the vigorous, interdependent and cyclical nature of resources and parts of life on the planet (Demediuk & Garma, 2015:1). Therefore, the broad rubric of sustainability within the supply chain requires an understanding of the environmental impact of economic activity, ensuring human needs are met, and ensuring that non-renewable resources are conserved (Carter & Rogers, 2008:363). It is clear that SSCM is a much broader approach to SCM and it takes great consideration of the economic, ecological and social aspects of business processes (also known as the triple bottom line) and theory (Svensson, 2007:263).

Organisations now use sustainability for performance evaluation and include the environmental impact of the supply chain when estimating comprehensive environmental footprints. Furthermore, managers recognise that the reputation and performance of the organisation can be affected by their supply chain performance; stakeholders are now demanding that organisations do more to reduce the detrimental environmental effects caused by their organisation's activities and the GHG emissions resulting in climate change (Kashmanian & Moore, 2014:13).

Within the global economy, the involvement of supply chain partners is essential in optimising the flow of products and material from producers to distributers to consumers as well as transport users (Furtado & Frayret, 2015:436). A flexible mode of transportation is road freight transportation which is capable of performing door-to-door services. Freight transport companies need to provide a versatile range of services at low cost in order to accommodate the diverse range of products and simultaneously seek innovative ways to become sustainable (Furtado & Frayret, 2015:436). Road freight transportation is a dominant mode of transport for most organisations while at the same time, it is a mode that causes the most serious environmental concerns (Piecyk, 2010:27). Road freight transport is a key driver for the economy and a chief contributor of GHG emission. Huisingh, Zhang, Moore, Qiao and

Li (2015:4) hold that the development of world trade is highly dependent on international transportation and that carbon emissions can range to over 10%t, depending on the type of goods and mode of transport being used.

Heavy freight trucking is one of the major logistics activities for supply chain organisations and accounts for two-thirds of total freight transport emissions (McKinnon, 2014:1). According to the Organisation for Economic Co-operation and Development (OECD) (2011:149), trucks are major consumers of oil. The rate of oil usage is increasing due to the fact that on a global scale, there has been an escalation in the quantity of goods being transported. By conducting business as per usual, the projected increase in global emission will be approximately 38 per cent from 2006 to 2030 (International Transport Forum, 2010). Reducing the dependency on oil without sacrificing the mobility and efficiency of the transport sector is a great challenge (European Commission, 2011). An increase in gross domestic product (GDP) and economic development results in an increase in transportation activities which leads to an increase of GHG emissions from transport (Jofred & Öster, 2011:6). Hence, in order to have a future that is sustainable, the increase of GHG emissions needs to be slowed down and ultimately reversed. This can be accomplished by adopting sustainable initiatives within the long-haul freight transport industry, including: eco-driving (Ericsson, Larsson & Brundell-Freij, 2006; Barkenbus, 2010; Cullinane, 2014; Mudgal et al., 2014); modal choice (Van Essen, Rijkee, Verbraak, Quak & Wilmink, 2009; Brogan et al., 2013; Protopapas, Kruse & Olson, 2013); routing and scheduling or eco-routing (Boriboonsomsin, Barth, Zhu & Vu, 2012; Scora, Boriboonsomsin & Barth, 2015; Zeng, Miwa and Morikawa, 2016); alternative fuel use (Solomon, 2010; Cullinane, 2014); improving freight logistics efficiency (Greene, Baker & Plotkin, 2011); and technical options such as low rolling resistance tyres, engine improvement, reduction of air resistance, increasing weight limit, lightweight construction and hybrid propulsion for distribution trucks (Van Essen, 2008).

The above appears to indicate that global supply chains have evolved bringing about vast complexities as well as an increase in detrimental environmental impacts. The resultant effect is the need for sustainable supply chain management. Limited research on sustainability, specifically within the road freight industry in South Africa, reveals a potential gap. Sustainable practices within the road freight industry are essential to address sustainability challenges, and as a result, imperative for the industry.

This purpose of this research is therefore to identify the different drivers that lead to the adoption of sustainable supply chain initiatives in reducing GHG emissions; to identify the benefits gained by implementing sustainable supply chain initiatives and to identify the challenges associated with the implementation of sustainable supply chain initiatives in the South African road freight sector.

RESEARCH METHODOLOGY

To explore the efficacy of implementing sustainable supply chain initiatives in the South African road freight industry, a case study approach was followed with the distribution of the research instrument to selected operating companies of one of South Africa's the largest diversified global logistics and supply chain management service providers. The questionnaire was distributed to almost 150 employees involved in sustainability management in 13 logistics operating companies and 108 responded. descriptive research design was utilised. Data obtained though the research instrument was analysed using descriptive and inferential statistics, which describe the sustainable supply chain practices implemented by

the various logistics operating firms. Convenience sampling was used in this study because of the ease of access to knowledgeable people, their availability at a given time, and the willingness of respondents to participate in the survey (Etikan, et al., 2016). A limitation of the convenience sampling is that generalisability from the results is weakened (Zikmund, et al., 2013)

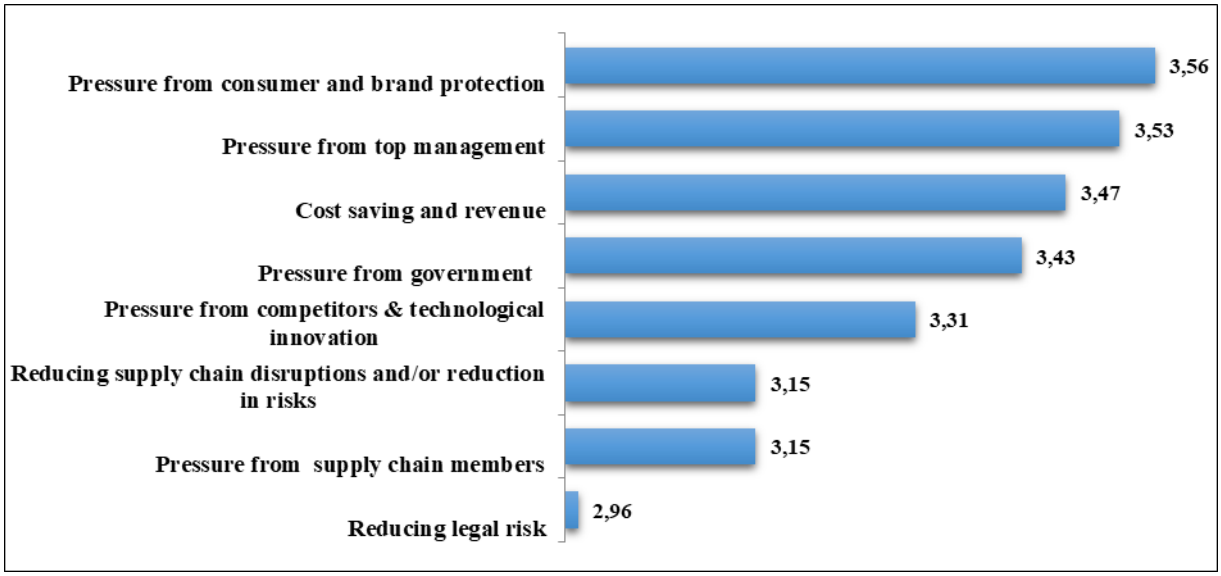
A self-administered survey, consisting of five separate sections, were sent out to employees of the selected operating firms who have relevant in-depth knowledge and expertise in order to obtain information about the benefits, barriers and driving forces of sustainable supply chain initiatives. The first section included questions regarding biographical information and general information about the respondent; the second section included the organisation's perspective on the driving forces for the adoption of sustainable initiatives and the activities within the organisation that emits GHG; the third section requested information about the various sustainable initiatives implemented and project investments; the fourth section requested the respondent to indicate the benefits that have been realised after the implementation of sustainable initiatives, including project returns and cost savings realised and the fifth section requested information regarding the possible challenges associated with the implementation of sustainable initiatives. The survey data was analysed using SPSS for Windows version 23.

DISCUSSION OF RESULTS

The results of the survey were analysed to explore the implementation of sustainable supply chain initiatives aimed at reducing greenhouse gas (GHG) emissions within the road freight sector in South Africa. The survey was completed by 108 respondents, from 13 logistics operating firms. Adopting sustainable initiatives require technical skills, relevant knowledge and competencies (Sabini, 2016). The results show that the most of the respondents concerned with sustainability initiatives were middle management (57.4%) and top management (22.2%), and have an average work experience of over 16 years. More than 62% of the respondents had completed tertiary qualifications. When asked to indicate their understanding of the concept of sustainability, most respondents (45.4%) implied that sustainability is a balance between finance, people and environmental dimensions, 23.1% indicated sustainability is about preserving natural resources for future generations, 13.9% revealed it is about meeting environmental needs, 13% indicated it refers to meeting current organisational needs and 4.6% indicated it is about meeting social needs.

Respondents were asked to rate the importance of the main drivers of sustainable supply chain initiatives on a five–point Likert-type scale. The response format was anchored from (1) = to no extent to (5) to a great extent. The three highest mean ranked drivers are pressure from consumers and brand protection, pressure from top management, and cost saving and revenue The Cronbach's α value for this question is 0.863, which indicate good reliability (Field, 2013). The mean ranking is depicted in Figure 1.

Figure 1: Drivers of sustainable initiatives in reducing GHG emission (mean scores)



Respondents were asked to rate the extent to which certain activities contribute to GHG emissions on a 5-point Likert-type scale. The response format was anchored from (1) = to no extent to (5) to a great extent. The mean and standard deviation were also calculated to establish the ranking of selected activities. The Cronbach's α value for this question was 0.899, which indicate good reliability (Field, 2013).

Table 1 depicts the proportional split and descriptive statistical results for the activities. In terms of perceived GHG emissions contribution, the three highest ranked activities are, outbound transportation, inbound transportation and consumption of paper.

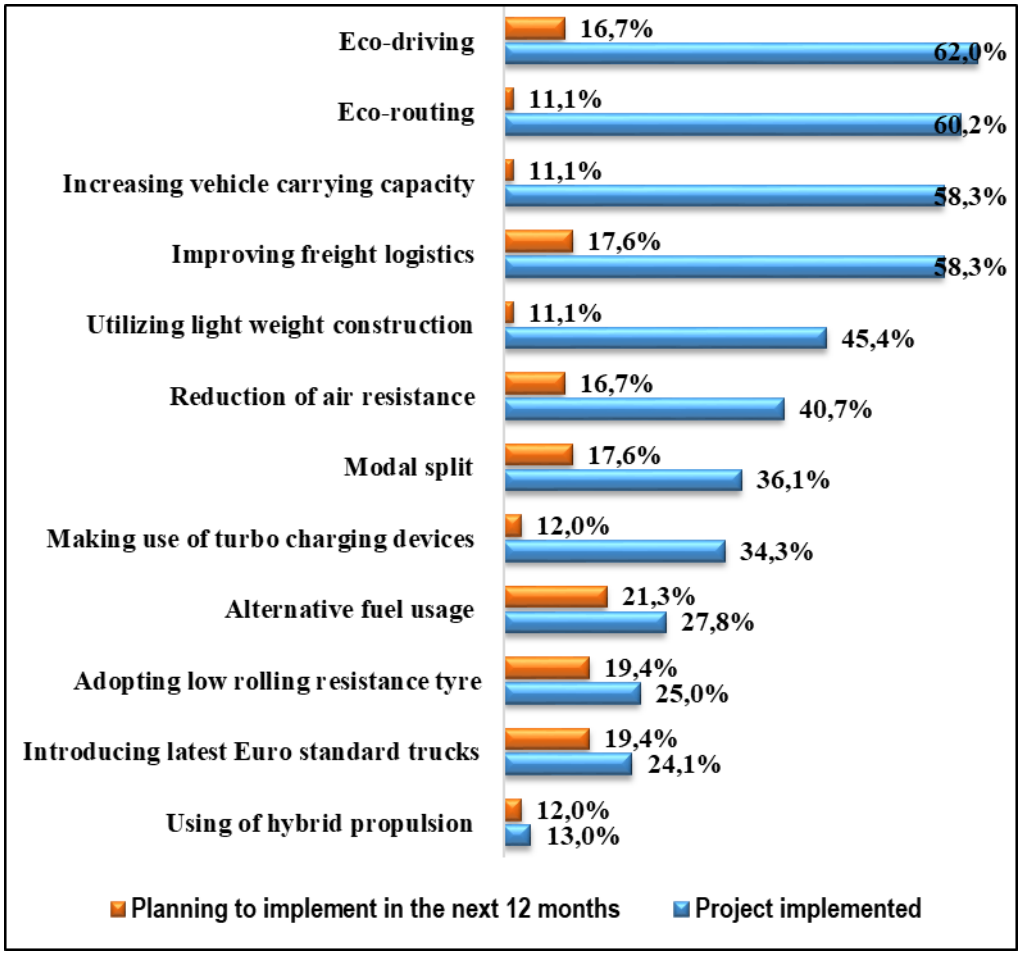
Table 1: Activities contributing to GHG emissions

Description	Mean	Standard deviation
Outbound transportation	4.08	0.99
Inbound transportation	3.79	1.22
Consumption of paper	3.50	1.16
Purchased electricity	3.13	1.09
Business travel by car	3.13	1.09
Operation of equipment	2.94	1.15
Facility emission – warehouse	2.84	1.25
Business travel by air	2.8	1.14
Facility emission – distribution centre	2.75	1.18

Description	Mean	Standard deviation
Purchased heating or cooling	2.69	1.16
Facility emission – office	2.67	1.03
Contracted waste disposals	2.56	1.2
Waste water treatment	2.55	1.16
Onsite landfills	2.37	1.26
Combustion of biomass/biofuels	2.34	1.26
Contracted waste water treatment	2.22	1.23
Purchased steam	2.18	1.24

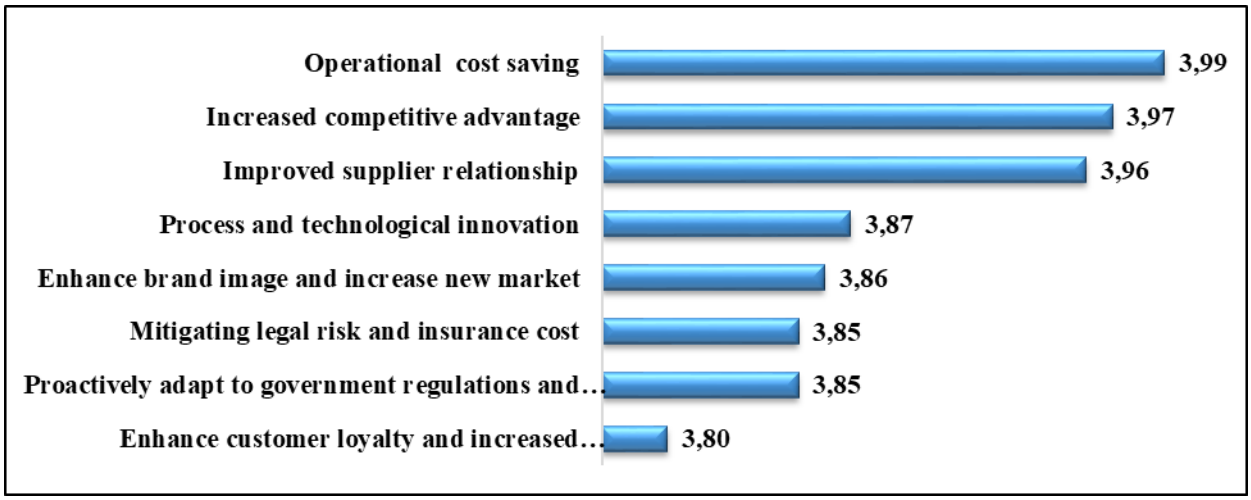
When asked to indicate the sustainable initiatives implemented (or planning to implement over the next 12 months), respondents indicated that the three most implemented initiatives were eco-driving (62%), eco-routing (60.2%) and increasing vehicle carrying capacity (58.3%). This is depicted in Figure 2. The Cronbach's α value for this question was 0.803, which indicate good reliability (Field, 2013)

Figure 2: Sustainable transport initiatives



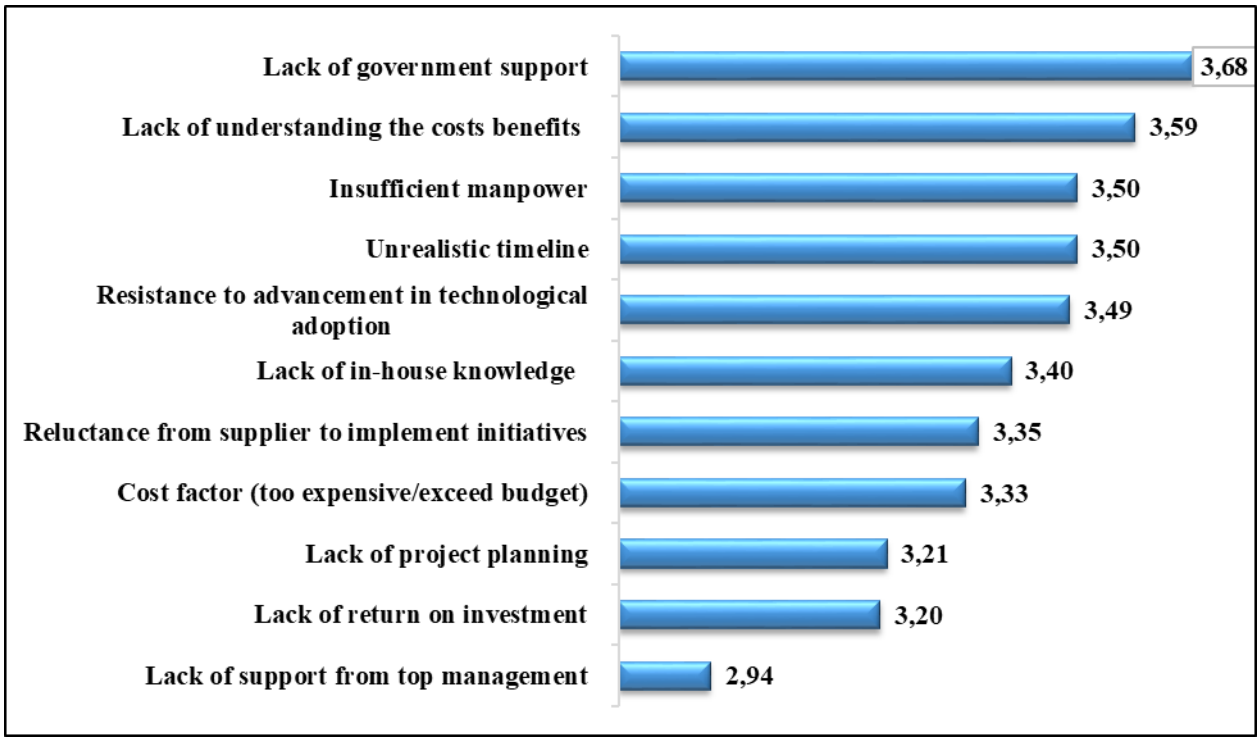
Respondents were asked to indicate the extent of the benefits attained from sustainable initiatives implemented. A five point Likert-type scale, anchored in strongly disagree (1) and strongly agree (5), was used to assess the level of achievement of the different benefits of sustainable initiatives. The top three benefits, as indicated by the respondents, were operational cost savings, increased competitive advantage, and improved supplier relationships. This is depicted in Figure 3. The Cronbach's α value for this question was 0.892, which indicate good reliability (Field, 2013)

Figure 3: Benefits of implementing sustainable supply chain initiatives (mean scores)



Despite the various benefits, numerous challenges are also experienced when implementing sustainable supply chain initiatives in reducing GHG emissions. Respondents were also asked to indicate the level of challenges they experienced when implementing sustainable practices. Lack of government support was the highest ranked (mean value of 3.68) challenge, followed by lack of understanding the cost elements and insufficient manpower. The mean rankings are depicted in Figure 4. The Cronbach's α value for this question was 0.857, which indicate good reliability (Field, 2013)

Figure 4: Challenges in implementing sustainable supply chain practices (mean scores)



CONCLUSION

The purpose of this study was to explore the implementation of sustainable supply chain initiatives in reducing greenhouse gas (GHG) emissions as well as create awareness within the road freight sector in South Africa.

The results firstly indicate that the main drivers to implement sustainable practices were pressure from consumers and brand protection, pressure from top management, and cost saving and revenue. Literature revealed that consumers are one of the driving forces that resulted in the evolution of the supply chain and also explicitly details that consumers are becoming more knowledgeable and are demanding services and products that are environmentally friendly. Further to this, protecting the brand image is important. A poor brand image can lead to reduction in consumers and hence, a reduction in sales and revenue. Hence, the top three drivers influencing the organisation to implement sustainable initiatives in reducing GHG emission is consistent with the literature.

Respondents identified the five main activities contributing to GHG emission within the selected logistics operating organisations are: outbound transportation, inbound transportation, consumption of paper, business travel by car, and purchased electricity. The logistics operating firms surveyed in this study represent almost 6000 vehicles of which the fuel consumption was responsible for 91% of the organisations' scope 1 emissions.

The five most implemented supply chain initiatives were eco-driving, eco-routing, increasing vehicle carrying capacity, improving freight logistics and utilizing light weight construction.

The results clearly indicate that by implementing sustainable supply chain initiatives in reducing GHG emissions, organisations do realise various benefits that not only provide them with the competitive edge, but also improve their image, relationships with stakeholders, and their processes within the organisation. However, despite the various benefits, numerous challenges are also experienced when implementing sustainable supply chain initiatives in reducing GHG emissions, with the main challenges being: Lack of government support, lack of understanding costs/benefits, insufficient manpower, unrealistic timelines and resistance to the adoption of advanced technology. The study also found that the initiatives that were least implemented were also the initiatives which were difficult to implement. Based on the empirical field research, lack of understanding of the costs and the benefits of sustainable supply chain initiatives was a dominant challenge. This can result in organisations not implementing sustainable practices. Thus, organisations need to conduct more studies pertaining to the feasibility of sustainable initiatives to be implemented. This should include cost factors, time constraints, capital required, among others. Furthermore, organisations can introduce guidelines and frameworks in order to implement sustainable initiatives.

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